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EXHIBIT 7

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EXPERT REPORT ON WHIRLPOOL FRONT-LOADING WASHER

BY

DR. R. GARY WILSON, PH.D., P.E.

NOVEMBER 16, 2009

IN SUPPORT OF

WHIRLPOOL FRONT-LOADING WASHER PRODUCTS LIABILITY LITIGATION

1:08-wp-65000 MDL No. 2001 Class Action

United States District Court Northeastern District of Ohio Eastern Division

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SIGNATURE PAGE

I was asked to examine the Whirlpool Access and Horizon automatic front loading clothes washers. As a result of these examinations and inspections, I have reached certain opinions to a reasonable degree of mechanical engineering and design of major home cleaning appliances area of expertise certainty relating to front loading automatic washers, including the Whirlpool Access and Horizon. All of the opinions expressed herein are to a reasonable degree of mechanical engineering and design of major home cleaning appliances certainty, unless otherwise stated.

Experts in the field of mechanical engineering and design of major home cleaning appliances reasonably rely upon laboratory operation and teardown of new machines, teardowns, inspections and evaluation of washers that have been used in consumers' homes, photographs of contaminated machines, and visits to consumers' homes to inspect machines, alone or in combination, to form opinions. In this case, I relied on each of these sources and in reaching opinions to a reasonable degree of certainty within my area of expertise.

The following report is respectfully submitted by:

ryWilson 11-16-09

Dr. R. Gary Wilson, Ph.D., P.E

ABSTRACT

The following report summarizes the evaluation of the front loading (horizontal axis) automatic washers, Access and Horizon, manufactured and sold by Whirlpool Corporation. These horizontal axis washers uniformly fail to self-clean. This results in the accumulation of the by-products of the washing process (Biofilm) which eventually supports the growth of mold and bacteria in various parts of the machine such as: The tub back wall and sump area (Figures 1&2), the basket bracket (Figure 3), and the pump strainer (Figure 4).



Figure 1: Tub Back Wall and Sump Area

Figure 2: Tub Back Wall Close-up



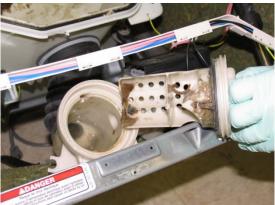


Figure 3: Basket Bracket

Figure 4: Pump Strainer

Once the bacteria and mold begin to grow a pronounced foul odor occurs that infiltrates the articles being washed and often the area surrounding the machine. After the Biofilm begins to accumulate it cannot be completely removed or eliminated by the machine or the consumer. Chemical washes may temporally reduce the amount of mold and bacteria but since the Biofilm remains this organic matter simply feeds on the Biofilm and grows back resulting in a systemic, persistent problem.

INTRODUCTION

In the North American automatic clothes washer market today there are both vertical and horizontal axis (front loading) washers. Both types of washers consist of the same major components which are:







• The "<u>Clothes Basket</u>" or just "Basket" in which the clothes are held during the wash process. It is the orientation of the spin axis of the basket that determines the type of washer (horizontal or vertical axis).







- The "<u>Tub</u>" surrounds the basket and contains the water/detergent mixture. During extraction of the wash water the basket spins within the tub and the water that is extracted from the clothes exits the basket through holes in the basket wall and is collected in the tub sump area and pumped to drain.
- The "Spin Motor" (right) which is either directly or indirectly attached to the basket and an electronic controller which can drive the motor at various speeds and in some cases in both a counter clockwise and clockwise direction.







• The "<u>Drain Pump</u>" or "Drain Pump/Motor" combination which may also be used as a recirculation pump if a diverter valve is included in the design. The ACCESS and HORIZON pump systems utilize a strainer.

- The "<u>Cabinet, Suspension system</u>" (shocks and springs) and balance ring (vertical axis) or ballast (horizontal axis).
- The "Washer Control System" which may be either an electromechanical or electronic control.

BACKGROUND

The subject of this report is the Whirlpool horizontal axis washers known as the ACCESS and the slightly smaller version which is referred to as the HORIZON. The axis of the ACCESS is tilted (canted) a few degrees up from the horizontal but the axis of the HORIZON is not canted. Other than this difference and the slightly smaller over-all size of the unit and components, the design of the two washers is identical (see <u>Appendix E</u>).

The plastic tub is supported in the cabinet by two springs and four shock absorbers. The stainless steel basket is cantilevered in the tub by a shaft that passes through a bearing set in the back of the tub (see Figure 5). On the outside back of the tub the shaft is attached to a large pulley that is connected to the spin motor by a flat drive belt. The shaft is attached to the back side of the basket by a three arm heavy cast aluminum bracket that is screwed to the basket.

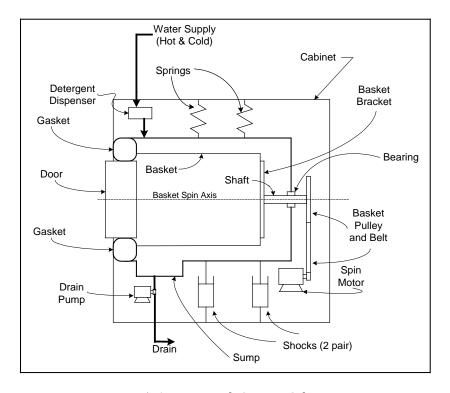


Figure 5: Access Wash System Schematic

At the six-o'clock position of the tub there is a flat recessed sump area where a rubber boot is attached that leads to the drain pump inlet. A ball that floats is contained in the boot and acts as a one-way or check valve that seals against the tub when the drain pump is not operating and therefore seals off the pump inlet and prevents detergent from entering the boot before it can be

dissolved into the wash water. Since the pump cannot completely empty the sump, water remains in the boot up to the tub and in the pump and in the lower portion of the drain hose. The pump has a built-in strainer at the suction port where the boot attaches to the pump.

In order to seal the tub and keep water from splashing or leaking out of the washer a rubber gasket is attached to the tub by a steel band and to the front of the cabinet by a steel ring of wire. When the washer door is closed it seals against the gasket providing a water tight system. The gasket also allows relative motion to occur between the tub and cabinet during the wash process. There is an air vent in the rear of the tub which vents out the back upper right corner of the cabinet.

GENERAL WASHER OPERATION

When clothes are placed in the washer and the detergent dispenser is charged with detergent the wash process begins by bringing water in through the detergent dispenser to flush the detergent into the washer tub and the basket begins to rotate at a low speed. Based on a water level control signal and the wash program in the computer controller, enough water is added to soak or saturate the clothes. As the clothes soak-up the water additional water is added until the water level stops changing. The clothes are initially in contact with a concentrated detergent water mixture which enhances the chemical energy input to the wash process. The tumbling of the clothes adds the mechanical energy necessary to loosen particulate soils and also assists in exposing all of the fabric surfaces to the wash liquor.

Thermal energy may be added to the wash process by the use of warm water from the water inlet and or in some models of the ACCESS and HORIZON by a heater element that is located in the sump. Depending on the wash program selected by the consumer the controller will begin to drain some of the wash water and add fresh water. In the case of the ACCESS and HORIZON the wash water is not recirculated. As the wash part of the process is completed more detergent laden water is drained and fresh water is added until eventually the vast majority of the detergent in the clothes is removed which marks the end of the rinse cycle.

At this point the washer begins a spin program which is designed to gently extract water from the clothes as the spin speed increases without damaging the fabrics by extruding them through the basket holes or plastering the clothes to the basket wall which may make wrinkles hard to remove.

The careful management of the water input, which is, only adding enough water to saturate the clothes and the judicious management of the energy input and relying heavily on the chemical energy allows the wash process to use a minimum amount of warm and/or cold water.

THE PROBLEM

Regardless of the type of washer (vertical or horizontal axis) there are certain fundamentals which must be observed in order to have a commercially successful cleaning product in the home. The four most important are:

- The product must be safe to operate and be safe to have present in the home.
- The product must be able to keep itself-clean and if necessary the consumer must be able to easily clean the product.
- The product must clean and not damage the clothes.

• The energy input (thermal, mechanical, chemical) must be managed in order to minimize the amount of warm or cold water that is required.

In the case of the ACCESS and HORIZON products that were evaluated, they uniformly fail to self-clean which often leads to a severe odor not only from the washer itself but also from the clothes and towels that have been washed in the machines.

DESCRIPTION OF THE PROBLEM

Within a matter of months and often only within a few weeks the ACCESS and HORIZON begin to produce an offensive order which not only emanates from the washer but also may permeate the clothes and towels that have been washed in the machine. The odor may be especially bad when the washer door is just opened or it may become noticeable when the washer is draining. If the washer door is left open the odor can actually drift out of the machine. The odor is a symptom of the actual problem which is, the machines uniformly fail to self-clean. Therefore a Biofilm forms and bacteria and mold begin to feed and grow on the Biofilm and eventually produce the offensive odor.

WHY IT HAPPENS

Because the ACCESS and HORIZON do not adequately clean or rinse the following components and areas:

- The tub walls, especially the back of the tub
- The Aluminum bracket that attaches to the basket
- The sump area
- The pump strainer and drain hose
- The door gasket area
- The air vent duct
- The detergent dispenser duct

Not adequately cleaning or rinsing results in a build-up of:

- suds that have dried out
- fabric softener
- soils of all types,
- lint
- body oils
- flakes of skin
- hair

and all the other debris that result from washing clothes collect in the areas that are not well rinsed and results in what is referred to today as "Biofilm" but may also be known as "Scrud." Eventually bacteria and mold begin to feed on this Biofilm and it is the excretions of these living organisms that produce the offensive odors.

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DESIGN ISSUES

THE TUB

The plastic tub is a major structural component that supports the basket by a shaft that runs through the back of the tub. This shaft with a heavy basket and bracket on one end is supported or cantilevered by the back of the tub (see Figure 5). The weight of the basket when it is full of wet clothes, the dynamic forces that are present when the basket is spinning and the off-balance forces that can occur requires a well designed wall in the back of the tub. As can be seen in the photographs in Appendix D, the inside back wall of the tub is clearly engineered for strength and minimum material usage. The deep cavities and ribs all help to strengthen the tub so that it can support the basket. However, the cavities and structure are on the water side and in locations where rinse water cannot adequately reach the cavities to flush them out. As can be seen in the photographs in Appendix C the newer ACCESS has what appears to be a different plastic and the ribbing and cavities are placed on the back side of the tub out of contact with the wash water. The new HORIZON still has cavities on the water side.

BASKET BRACKET

The heavy cast Aluminum bracket that is attached to the back of the basket has cavities which cannot be rinsed out to prevent the collection of material similar to that of the back wall of the tub (See Appendix D). Even with the spinning motion of the bracket severe amounts of debris still collect on the bracket. The photographs in Appendix C show that the newer ACCESS has basket brackets that have been redesigned to remove the cavities.

SUMP AREA

The sump area, while not as severe a collection point as the tub back wall and bracket, does collect debris and Biofilm in spite of the fact that this area experiences rinsing. But this is an area where water is collected and not completely drained at the end of the wash process (see Appendix D).

PUMP STRAINER AND DRAIN HOSE

As the photographs in $\underline{\text{Appendix D}}$ and $\underline{\text{F}}$ show, the strainer can be a severe collection point and the drain hose with the corrugations also traps debris. This is probably one source of the odors that occur when the washer drains.

DOOR GASKET

The door gasket is often a location of severe build-up of Biofilm and other debris. The consumer can at least reach the outer surface of the gasket to clean it. However, the interior surface of the gasket and the immediate tub areas are prime collection points for Biofilm which supports the growth of bacteria and mold. The gasket can be easily replaced (easy compared to the tub) and the immediate area can then be accessible for cleaning.

MANAGING THE PROBLEM

All of the areas mentioned in the last section represent design flaws resulting from the neglect of the fundamental principle that a cleaning appliance must be able to clean itself or at the very least

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(Expert Report on Whirlpool Front Loading Washer Continued)

provide a means where by the consumer can easily clean the washer. Once the Biofilm collects in locations where water cannot easily rinse out the cavities, then bacteria and mold begin to grow and multiply. Chemical washes may destroy some or even most of the living organisms where it comes into direct contact with them. However, the remaining organisms simply recontaminate the Biofilm and multiply until they produce enough by-products that the odor reoccurs. In addition, chemical washes cannot adequately reach all of the locations on the back wall of the tub.

SUMMARY

The North American washing machine market today has both vertical and horizontal axis washing machines. Historically the North American market has been primarily vertical axis machines with effective self-cleaning approaches in the design. American consumer expectations, habits, and practices are based on decades of using machines that effectively self-clean. The ACCESS and HORIZON models that were evaluated from the 2002-2008 time period uniformly failed to self-clean which often lead to a severe odor from the machine and the clothes that were washed.

Uniformly Inherent in the design of these machines are areas, such as the cavities in the tub back wall and the basket bracket, where rinse water cannot adequately reach. Once the Biofilm builds up and the bacteria and mold begin to grow, there is no effective way to permanently or completely eliminate the problem and the resulting odor.

Newer models of the ACCESS and HORIZON have some design modifications, such as the ribs and cavities on the ACCESS tub which have been moved to the back side of the tub out of contact with the wash water. The basket brackets of the ACCESS and HORIZON have been redesigned to reduce collection points. In addition, consumer instructions for cleaning processes and special cleaning cycles have been added to the washers. Whirlpool has also made special cleaning tablets available. The effectiveness of these changes have not been evaluated. Consumers with ACCESS or HORIZON models from the time period that was evaluated (2002-2008) do not have solutions available to resolve or eliminate the containments and the resulting odor.

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(Expert Report on Whirlpool Front Loading Washer Continued)

APPENDIX A: QUALIFICATIONS AND EXPERIENCE

My name is Raymond Gary Wilson. At present I am on the Mechanical Engineering and Engineering Science faculty at the University of North Carolina at Charlotte in Charlotte, North Carolina. I also provide consulting services under the company name RGW Research and Engineering.

In 1975 I received a Bachelor of Science degree in Mechanical Engineering from Tennessee Technological University and in 1976 I received a Master of Science in Mechanical Engineering from the University of Illinois at Urbana-Champaign. After a 25 year career in industry I returned to school as a full time Ph.D. candidate. In 2004 I received a Ph.D. in Mechanical Engineering from Case Western Reserve University in Cleveland, Ohio.

I am a licensed Professional Engineer in the state of Michigan (No. 27261) and the state of South Carolina (No. 27489). In addition I am licensed as a Model Law Engineer (No. 37207) by the National Council of Examiners for Engineering and Land Surveying.

I began my industrial career when I joined Whirlpool Corporation in 1976 as an Engineer in the Mechanical Systems Research Department, Thermal Fluids Analysis Group located at the Research and Engineering Center in Benton Harbor, Michigan. I conducted applied research on refrigeration and air conditioning products until 1984 when I transferred to the Evansville Indiana division to manage a refrigerator and air conditioner compressor group.

In 1985 I transferred back to Benton Harbor as a team leader for the development of a refrigerator, dishwasher, and combination clothes washer/dryer microgravity operable ground test units for the Space Station. At the completion of these contracts I became in charge of an Advance Development group that developed prototypes of a high performance clothes washing system also known as a concentrated wash system. We also developed water saving spray rinse technology.

In 1989 I transferred to the St. Joseph Technology Center as a Manager of the Kenmore Dishwasher Model line. In 1992 I became the Manager of the Dishwasher Cost & Quality department. Then in 1994 I was promoted to the Director of Dishwasher Technology in charge of the entire dishwasher design organization and I ran the design teams that did a complete redesign of the KitchenAid dishwasher.

In 1997 I became the Director of Laundry Technology in charge of a new technology out-of-water concentrated wash system project that was behind schedule and not on specification. While restructuring this project I also managed a second team that implemented the new technology of concentrated wash onto an existing vertical axis platform that was put into production in order to secure a key customer and to test the new technology.

In 1999 I took an educational leave of absence and entered Case Western Reserve University as a Ph.D. candidate. Two years later I resigned from Whirlpool Corporation and completed the degree in 2004. In August of 2005 I joined the Mechanical engineering department at the University of North Carolina at Charlotte.

My complete resume is attached as Appendix G. I am being compensated for my time on this case at a rate of \$500/hour and I have not been involved in any other cases.

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(Expert Report on Whirlpool Front Loading Washer Continued)

APPENDIX B: MATERIALS REVIEWED

DEPOSITIONS

The following depositions were reviewed:

- 1) Tracy Snyder, Harrisburg, North Carolina, June 9, 2009
- 2) Gina Glazer, Cleveland, Ohio, June 17, 2009
- 3) Rebecca A. Nordan, Davidsonville, Maryland, June 10, 2009
- 4) Jeffrey Glennon, E. Hills, New York, June 15, 2009
- 5) Karen Hollander, Boca Raton, FL, June 17, 2009
- 6) Shannon Schaeffer, Murrieta, CA, June 18, 2009
- 7) Anthony Hardaway, Stevensville, MI, September 15, 2009

TEARDOWNS

1) I participated in a joint teardown and evaluation with Whirlpool representatives of seven ACCESS washers at the Whirlpool Research and Engineering Center in Benton Harbor Michigan on October 29, 2009. The serial numbers and models numbers of the machines that were torn down are (see Appendix D):

a.	CSW0306789	WFW9500TW01	Whirlpool	Schorndorf	2008
b.	CSW291?042	110 42926	Kenmore	Schorndorf	2008
c.	CSP3502234	GHW925ML0	Whirlpool	Schorndorf	2003
d.	CSS4913466	KHWS02RMT0	KitchenAid	Schorndorf	2005
e.	CSN0308222	GHW9100LW1	Whirlpool	Schorndorf	??????
f.	CSM4712021	GHW9100LW1	Whirlpool	Schorndorf	2002
g.	CSR3103260	GHW9150PW0	Whirlpool	Schorndorf	2004

2) I hosted and participated in a joint teardown and evaluation with Whirlpool representatives of four ACCESS washers on November 5, 2009 in Charlotte, North Carolina. The serial numbers and models numbers of the machines that were torn down are (see Appendix D):

a.	CSR0407232	GHW9250MT1	Whirlpool	Schorndorf	2004
b.	CSR3701615	GHW9150PW0	Whirlpool	Schorndorf	2004
c.	CSS1208971	GHW9150PW0	Whirlpool	Schorndorf	2005
d.	CSR1910188	GHW9100LW2	Whirlpool	Schorndorf	2004

PLANTIFF VISIT

I visited Tracy Snyder in Harrisburg, North Carolina and partially disassembled and reviewed her machine (see Appendix F)

APPENDIX C: NEW ACCESS REFERENCE PHOTOGRAPHS

















New DUET Reference Pictures Serial No. HLW3292761 Build Date: week 39 of 2008 1 of 6

















New DUET Reference Pictures Serial No. HLW3292761 Build Date: week 39 of 2008 2 of 6

















New DUET Reference Pictures Serial No. HLW3292761 Build Date: week 39 of 2008 3 of 6













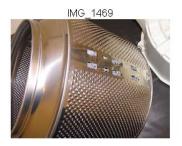




New DUET Reference Pictures Serial No. HLW3292761 Build Date: week 39 of 2008 4 of 6

















New DUET Reference Pictures Serial No. HLW3292761 Build Date: week 39 of 2008 5 of 6











New DUET Reference Pictures Serial No. HLW3292761 Build Date: week 39 of 2008 6 of 6

APPENDIX D: PHOTOGRAPHS, CONTANIMATED WASHERS

TEARDOWN AT WHIRLPOOL IN BENTON HARBOR

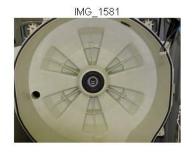
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Serial No. CSW0306789 Build Date: week 03 of 2008 2 of 4

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Serial No. CSW0306789 Build Date: week 03 of 2008 3 of 4













Serial No. CSW0306789 Build Date: week 03 of 2008 4 of 4

Serial No. CSW291?042 Model No. 110 42926

Kenmore

Build Date week 29 of 2008

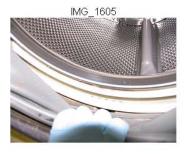
















Serial No. CSW2917042 Build Date: week 29 of 2008 1 of 9

















Serial No. CSW291?042 Build Date: week 29 of 2008 2 of 9













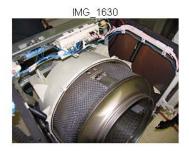




Serial No. CSW291?042 Build Date: week 29 of 2008 3 of 9









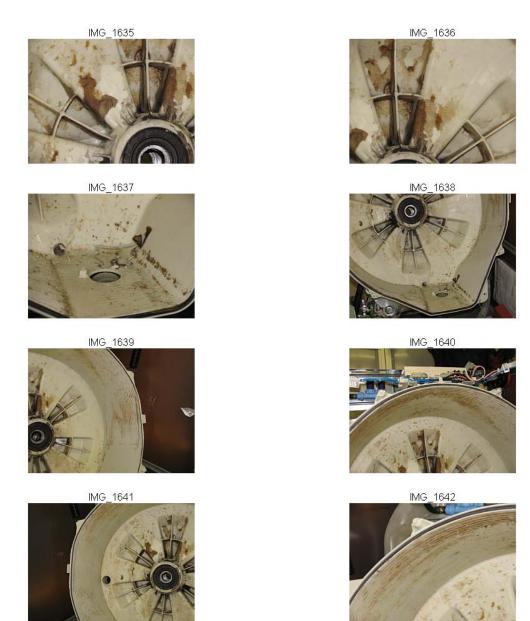




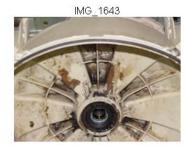




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Serial No. CSW2917042 Build Date: week 29 of 2008 5 of 9









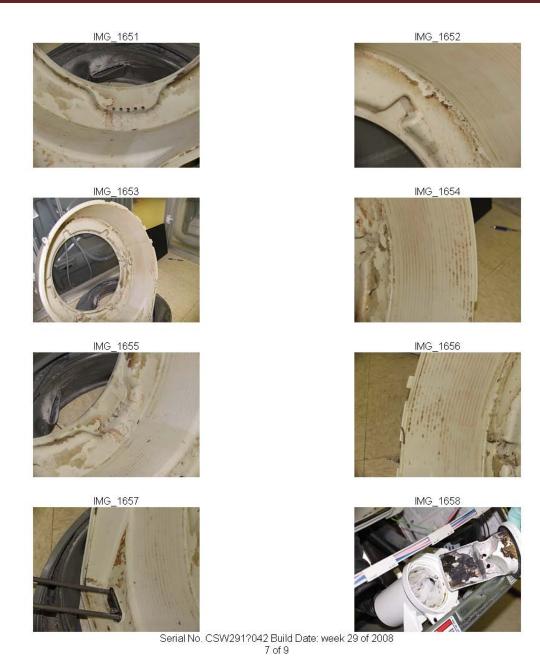








Serial No. CSW2917042 Build Date: week 29 of 2008 6 of 9



















Serial No. CSW291?042 Build Date: week 29 of 2008 8 of 9

















Serial No. CSW291?042 Build Date: week 29 of 2008 9 of 9

Serial No. CSP3502234 Model No. GHW925ML0

Whirlpool

Build Date: Week 35 of 2003



1 of 8

















Serial No. CSP3502234 Build Date: week 35 of 2003 2 of 8

















Serial No. CSP3502234 Build Date: week 35 of 2003 3 of 8



Serial No. CSP3502234 Build Date: week 35 of 2003 4 of 8

Dr. R. Gary Wilson, Ph.D., P.E.









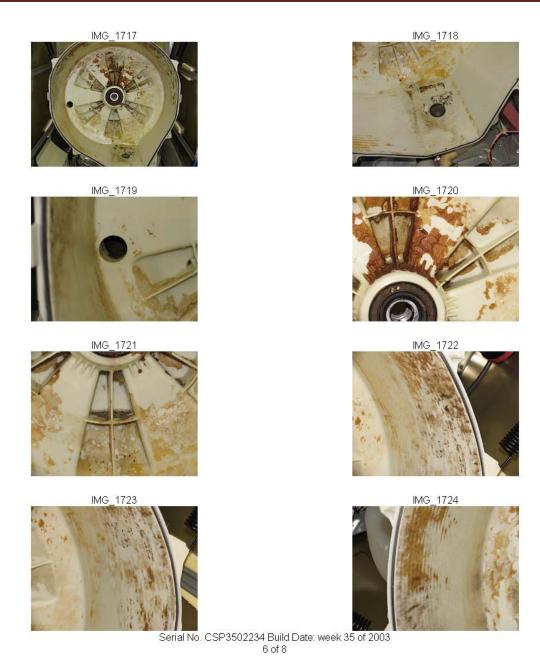


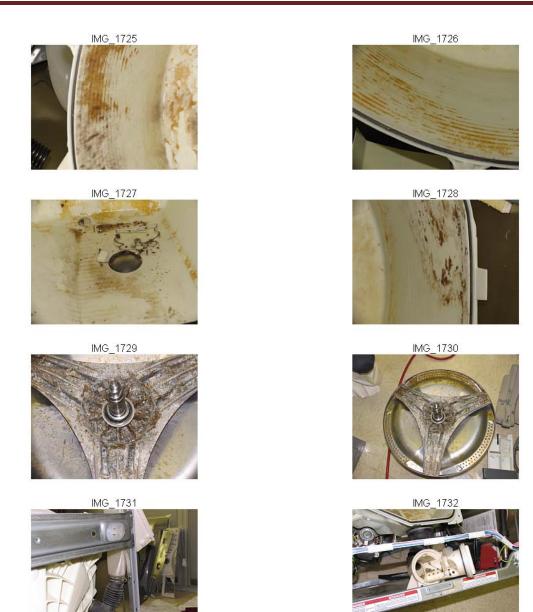






Serial No. CSP3502234 Build Date: week 35 of 2003 5 of 8





Serial No. CSP3502234 Build Date: week 35 of 2003 7 of 8

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Serial No. CSP3502234 Build Date: week 35 of 2003 8 of 8

Serial No. CSS4913466 Model No. KHWS02RMT0

KitchenAid

Build Date: Week 49 of 2005

















Serial No. CSS4913466 Build Date: week 49 of 2005 1 of 6













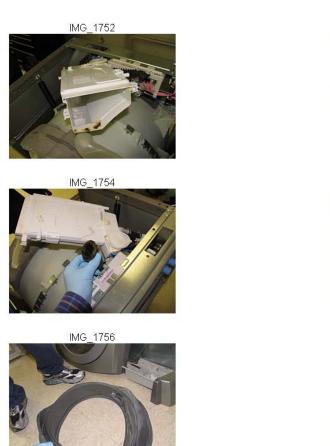




Serial No. CSS4913466 Build Date: week 49 of 2005 2 of 6

Serial No. CSS4913466 Build Date: week 49 of 2005 3 of 6

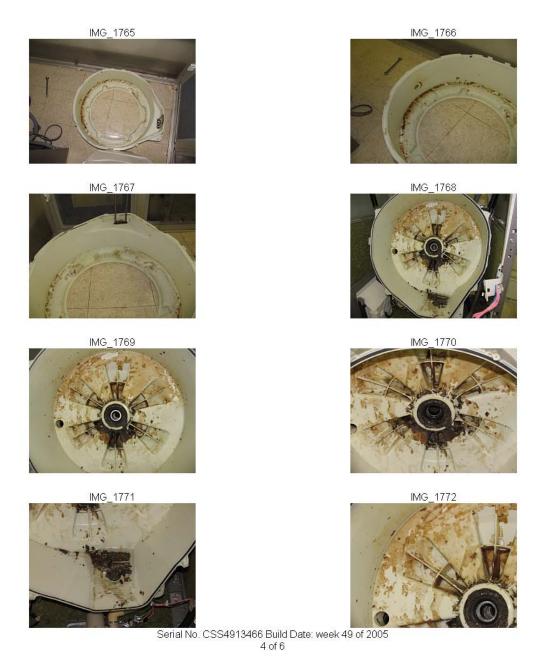
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(Expert Report on Whirlpool Front Loading Washer Continued)





Serial No. CSS4913466 Build Date: week 49 of 2005 6 of 6 Serial No. CSM4712021 Model No. GHW9100LW1 Whirlpool Build Date: Week 47 of 2002



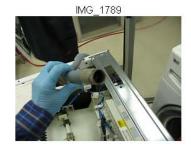














Serial No. CSM4712021 Build Date: week 47 of 2002 1 of 5









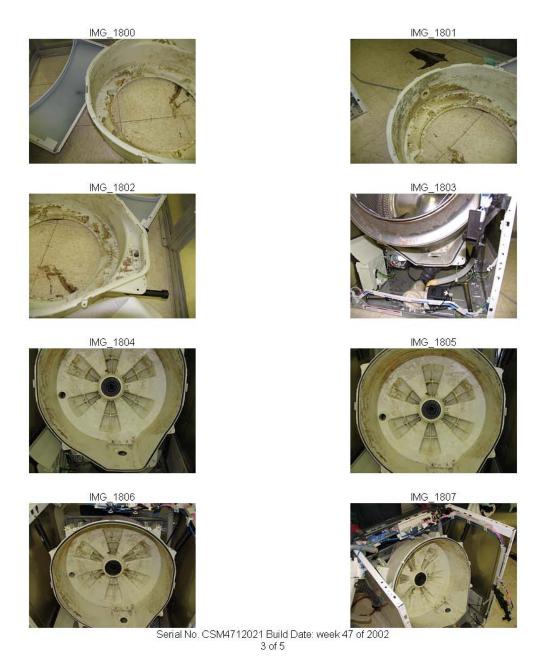


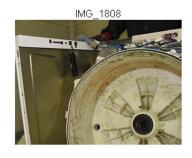


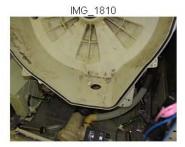




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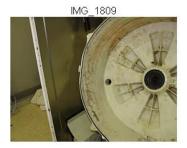


















Serial No. CSM4712021 Build Date: week 47 of 2002 4 of 5